

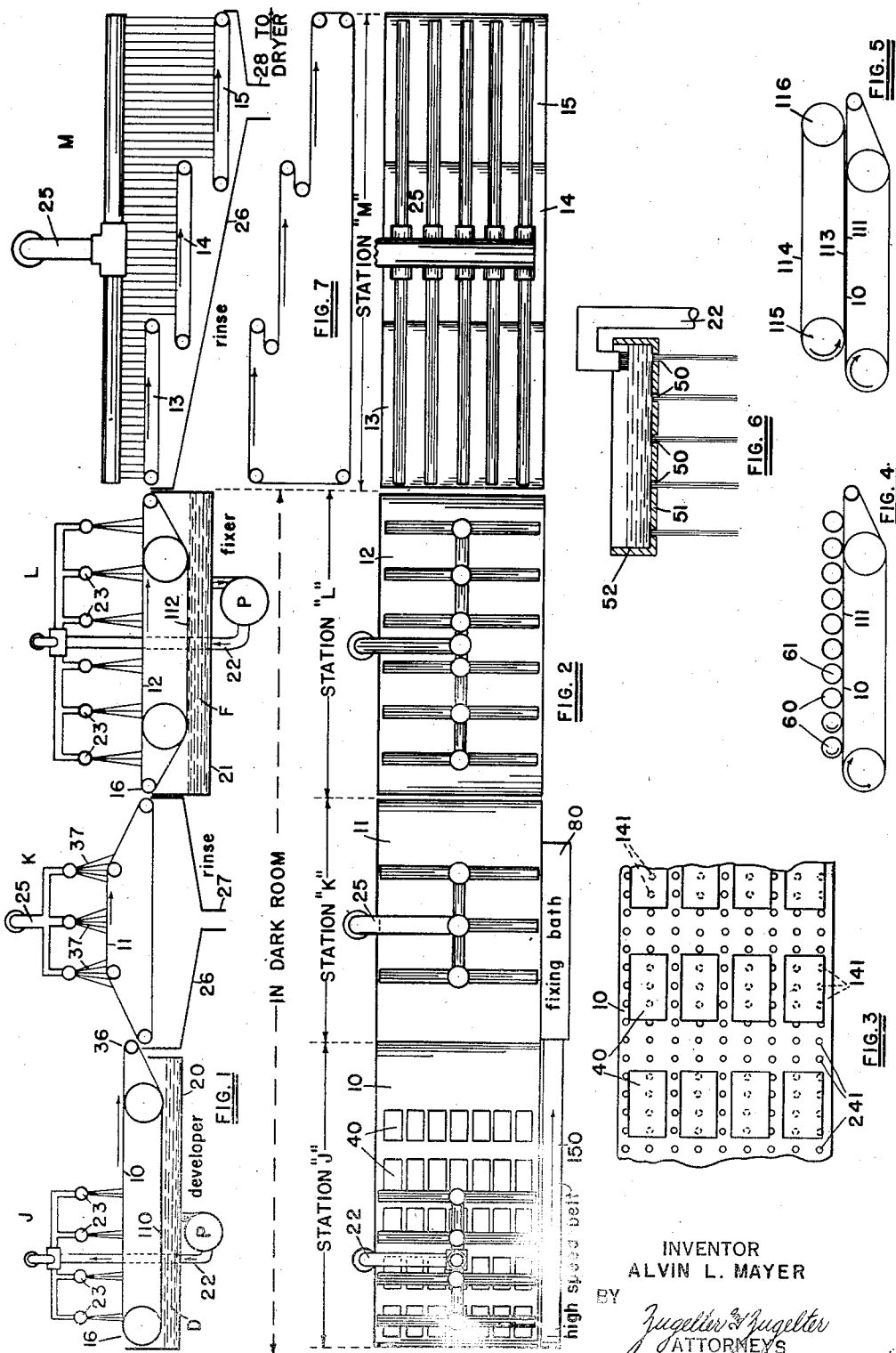
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A. L. MAYER

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APPARATUS FOR DEVELOPING EXPOSED PHOTOGRAPHIC PRINTS

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INVENTOR
ALVIN L. MAYER

BY

Jugelter & Jugelter
ATTORNEYS

UNITED STATES PATENT OFFICE

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APPARATUS FOR DEVELOPING EXPOSED
PHOTOGRAPHIC PRINTS

Alvin L. Mayer, Cincinnati, Ohio

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This invention relates to photographic equipment, and more particularly to apparatus for continuously developing exposed photographic prints.

An object of the present invention is to provide apparatus into which individually exposed, but undeveloped prints may be fed, and from which they will be discharged completely developed, fixed and washed ready for drying.

Another object of the invention is to provide a device having the hereinabove described characteristics, wherein all the various steps followed incident to developing an exposed print may be under the supervision of an attendant, who may, when occasion demands, accelerate or retard the rate of travel of certain individual prints in accordance with their particular rates and degrees of reaction to the developing process, whereby the prints being automatically developed may, nevertheless, be under the direct personal supervision of an attendant.

Still another object of the invention is to provide in a device of the character stated, means for directing streams of developer, rinse water, hypo solution and rinse water onto the prints as they are conveyed through the device in such a manner that the individual prints are moistened rather than soaked, as is the case when prints are run through or immersed in a bath.

Another object of the invention is to provide a developer wherein only the sensitized side or face of the sheets of exposed printing paper is subjected to the action of the developer solution, the first wash and the subsequent action of the fixing or hypo solution, with the result that the prints after their final washing may be rapidly dried, thereby considerably shortening the overall time required to produce the finished print, without sacrificing quality of the finished product.

Another object of the present invention is to provide an improved print conveyer for an automatic, continuous print developing device, said conveyer being designed whereby to effectively preclude shifting or slipping of the prints upon and relative to the conveyer.

Still a further object of the invention is to provide a fully automatic multi-tank, developing device for individual prints, wherein the chemical solutions of the various tanks are recirculated through individual circuits.

These and other objects are attained by the means described herein and disclosed in the accompanying drawing, in which:

Fig. 1 is a side diagrammatic view of one em-

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bodiment of the device comprising the present invention.

Fig. 2 is a top plan view of the device of Fig. 1.

Fig. 3 is a fragmental top plan view of a conveyer belt which comprises a detail of the present invention.

Figs. 4 and 5 are modifications of drive means for precluding slipping of individual prints relative to their conveyer belt as they are subjected to the action of the developer, wash and hypo solutions.

Fig. 6 is a modified type of fluid discharge means, which comprises a detail of the present invention.

Fig. 7 is a single belt conveyer system which may be used in place of the three belt system disclosed at station M of Fig. 1.

With particular reference to Fig. 1, it will be observed that the present device may comprise a conveyer system upon which exposed, but undeveloped photographic prints may be placed whereby to be subjected to the successive action of a developer solution, a water rinse, a fixing bath, and another water rinse. The prints upon discharge from the device are adapted to be transferred directly to a print drying machine, of any suitable design.

In the particular embodiment of the invention illustrated, the conveyer system comprises a plurality of short, independent conveyers denoted generally by the numerals 10, 11, 12, 13, 14 and 15, driven by appropriate means, not illustrated.

For brevity of description and clarity of detail, it will be assumed that the present device comprises four stations, denoted generally by the letters J, K, L and M. Station J may comprise a developer station at which exposed prints may be subjected to the action of any suitable developer solution; station K may comprise a rinse station at which any developer solution carried over from station J is washed from the prints; station L may comprise a fixation station at which the washed prints from station K are subjected to the action of a fixing solution; station M may comprise a second rinse station at which the fixer solution from station L is washed from the prints. In the preferred embodiment of the invention, separate conveyer means such as 10, 11 and 12 may be provided for imparting a linear motion to the prints for moving them through stations J, K and L respectively, and other separate conveyer means such as 13, 14 and 15 may be provided for moving the prints through station M, for reasons hereinafter made more fully apparent. With particular reference now to stations J and

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L, it will be observed that the developer solution D and the fixer solution F are adapted to be continuously circulated from their respective tanks 20 and 21 through conduits 22 thence to discharge nozzles 23, by means of suitable recirculating pumps P thereby permitting the solutions to be used over and over. It should be observed that the lower reaches 110 and 112 of conveyers 10 and 12 respectively are disposed above the level of the fluids normally housed in tanks 20 and 21 by an amount sufficient to preclude wetting of said lower reaches incident to the normal operation of the device. By reason of such an arrangement the receiving ends 13 of these conveyers will be substantially free of the fluids housed within tanks 20 and 21, except for such fluid discharged from nozzles 23 as may be retained on the conveyers.

With reference now to stations K and M, it will be observed that a supply of rinse water from suitable supply pipes 25 is adapted to be discharged onto the upper reaches of conveyor means 11, 13, 14 and 15, thence into drain pans 26 from which it may be discharged into suitable sewer connections denoted generally by the numerals 27 and 28.

Individual sheets of exposed, but undeveloped prints are adapted to be placed on the charge end 16 of conveyor 10 which will impart a linear motion thereto through station J and transfer the prints onto conveyor 11 from which they will be transferred onto the conveyor 12, and thence onto conveyor 13. At this point it should be observed that the prints remain with their front, sensitized face uppermost as they are moved through stations J, K, L and onto conveyor 13 of station M. However, as the prints are transferred from conveyor 13 to conveyor 14 they are turned over thereby disposing their backs or rear, unsensitized surfaces uppermost, and as the prints are transferred from conveyor 14 to conveyor 15 they are once again turned over for disposing their top surfaces uppermost. It has been found that by subjecting only the top, sensitized surfaces of the prints to the successive actions of a developer solution, a rinse solution, a fixer solution and a second rinse solution, that the prints are moistened as contrasted to the soaking to which they would be subjected if they were wholly immersed in the various solutions. The practical result of moistening the prints rather than soaking them, is two-fold, viz., inasmuch as the underside of the prints are subjected to very little, if any, of the developer and fixed solutions, the prints may be thoroughly washed much faster than has heretofore been possible; and the prints after being thoroughly washed may be dried much faster since the print has not had an opportunity to soak up much moisture.

The reversal or overturning of the prints as above described, results from the fact that by the time the prints reach the discharge end of conveyor 13, they have become sufficiently wet to lose most of their stiffness, and will accordingly tend to adhere to the conveyor belt and follow the belt toward the return reach thereof. However, the water spray from 25 will strike the trailing ends of the prints as the prints proceed to the lower reach of the belt, thereby dislodging them and depositing the prints in overturned condition upon the underlying upper reach of conveyor belt 14. It is for this reason that belts 13, 14 and 15 are made to overlap at their ends, with a substantial vertical distance between them. This behavior of the prints does

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not occur at stations J, K and L, for the reason that in the earlier stages of the process the prints retain enough of their initial rigidity to cause them to bridge the gaps between conveyers 10, 11, 12 and 13, which are substantially coplanar. Moreover, each successive conveyor belt is in position to pick up a print at its leading edge, and to perpetuate advancement thereof face up. At conveyor belts 13, 14 and 15, however, the prints are free to follow the belts around the ends of the conveyers, until the prints are reversed or overturned and then dislodged by the water spray.

In order to provide means for holding the individual prints on the upper reach of the various conveyers without shifting, and in order that the various solutions discharged onto the upper reaches may be drained off, the conveyers are preferably constructed with a plurality of holes, or perforations, such as disclosed in Fig. 3. It has been found that prints, denoted generally by the numeral 40, when placed on a belt perforated as disclosed in Fig. 3 will not be shifted or floated around by the action of the various solutions discharged thereon, as is the case when a substantially solid belt is used. It is believed that the perforations 241 permit a suction to be created between the underside of the prints and those perforations covered by the prints, such as perforations 141, and this condition is emphasized by reason of the fact that any fluid which would otherwise stand on the belt is drained through the uncovered perforations 241 which surround the various prints. If desired, the conveyor belt may be fabricated from canvas, rubber, or the like, suitably perforated, or it may comprise a metal link belt, wherein the spacing around the individual links functions precisely as the perforations 241 of the belt disclosed in Fig. 3.

With particular reference now to station J of Fig. 1, it will be observed that the developer solution spray nozzles 23 are adapted to moisten the prints carried by conveyor 10 for but a portion of the lineal distance between receiving end 16 and discharge end 36, whereby the chemical action of the developer solution in reducing the light sensitive gold or silver salts of the upper, sensitized surfaces of the prints to a metallic state is permitted to continue in the atmosphere, and without the addition of more developer solution. Experiment has indicated that the results obtained by subjecting an exposed film to developer solution for forty seconds and in permitting the chemical reaction to continue in the atmosphere for ten seconds, are far superior to the results obtained when the same type of prints are subjected to the direct action of developer solution for fifty seconds. It should be understood that the values mentioned in the foregoing example are exemplary rather than restrictive, and are not intended to indicate critical limits, since the ratio of length of time during which an exposed print is subjected to the direct action of a solution to the length of time in which the developing action of the fluid is permitted to occur in the atmosphere may vary for different films, the particular concentration of developer solution, and other well-known, variable factors. Inasmuch as the present device is primarily adapted for individually developing and fixing exposed photographic prints on a commercial scale, it will be appreciated that there will be a certain amount of variation in the physical and chemical characteristics of the exposed prints

fed into the device which will result in different rates of development of the prints, in other words some of the prints will be developed at a faster rate, and other prints will be developed at a slower rate than the average rate required for most of the prints run through the device. In order that the rate of development of the various prints passing through station J may be controlled, it is desirable that an attendant be stationed at this station whose duty it is to observe the rate of development of the various prints disposed on the upper reach of conveyer 10. In the event that the rate of development of any particular print is excessive, the attendant will preferably manually retrieve said print and place same on a high speed belt 150 which will rapidly transfer the print to a fixing bath 80, or he may plunge said print directly into a fixing bath conveniently located adjacent station J. In this manner many of those prints which would hitherto be over-developed and thereby rendered useless, may be saved. In the event that the attendant should observe that the rate of development of certain prints is too slow, he may retrieve these prints and place them on conveyer 10 for another passage under nozzles 23.

The prints upon reaching discharge end 36 of conveyer 10 are adapted to be transferred to the upper reach of conveyer 11 which is adapted to move them beneath the streams 37 of rinse water. The prints are then transferred onto the receiving end 16 of conveyer 12 which moves them under nozzles 23, from which quantities of fixing solution are discharged.

With particular reference now to station M, it will be observed that the prints will be thoroughly washed on both sides by reason of the relationship of conveyers 13, 14 and 15. Experiment has indicated that when prints are turned but twice while being subjected to the action of rinse water that all traces of the fixer solution are effectively removed from the prints, which may then be fed, by means of a suitable conveyor, not illustrated, to a print drying device, not illustrated.

As indicated in Fig. 1, stations J, K and L are preferably located in a dark room, whereas station M may, if desired, be located outside of the dark room.

In those instances where it is desired to eliminate nozzles, the construction disclosed in Fig. 6 may be utilized for dispensing the various solutions onto the upper reaches of the various conveyers. By reason of the construction disclosed in Fig. 6, the various nozzles 23 may be dispensed with and the same effect gained by providing a plurality of spaced apertures 50 in the bottom element 51 of a tank or trough denoted generally by the numeral 52. The fluid from tanks 20 and 21 may now be piped by means of conduit 22 into trough or container 52 from which it may flow by gravity through holes 50. If desired, this system may be likewise used at stations K and M for distributing rinse water onto the conveyers and prints disposed thereon.

If desired the three conveyer units 13, 14 and 15 may be replaced by the one unit disclosed in Fig. 7 wherein one long belt is caused to pass around an arrangement of pulleys, whereby the same result is obtained as gained by means of the three conveyors of station M. In those instances where it is desired to immerse individual prints in developer, rinse, fixer and final rinse solutions, the constructions disclosed in Figs. 4 and 5 may be applied, wherein means for preventing relative motion of the individual prints relative to

the upper reach of a conveyer while the prints are immersed in the solutions are disclosed. In Fig. 4 a plurality of idler pulleys denoted generally by the numeral 60 are suitably mounted above the upper reach 111 of conveyer 10 whereby to hold the prints against the conveyer belt. It should be understood that pulleys 60 may be mounted for rotation about their longitudinal axes 61, by appropriate means, not disclosed.

In Fig. 5 the individual prints are adapted to be held in place upon the upper reach 111 of conveyer 10 by means of the lower reach 113 of an endless belt 114 which extends around a pair of spaced pulleys 115 and 116, as shown. It should be understood that although only conveyer 10 is illustrated in Figs. 4 and 5, the print holding means disclosed in these figures could be applied to all of the conveyers upon which the prints would be transferred as they pass through the device.

For clarity of understanding, it should be understood that the term development as used herein relates to the process of rendering visible the image on an exposed photographic film usually by reduction of gold or silver salts to the metallic state, and that the term developer solution relates broadly to any reducing liquid used in photography for rendering the image on an exposed print visible by the formation of black metallic silver. The process of fixation relates to the process of dissolving the light sensitive gold or silver salts from the films or prints, thus making them insensitive to the further action of light, and the term fixing bath or fixer solution as used herein relates to any solution used for the fixation of photographic plates, films, or papers.

It should be understood that various modifications and changes may be made in the structural details of the device, such as, by way of example, providing the various stations J, K, L and M in vertical, rather than horizontal alignment and of enclosing the device in a cabinet type housing, within the scope of the appended claims, without departing from the spirit of the invention.

It should be noted, that if desired in some instances, additional spray nozzles 23 may be provided at station J in order that the prints carried by conveyer 10 will be subjected to the direct action of the developer solution for the entire lineal distance between points 16 and 36. Such a procedure would be followed in those instances where the present device is used to continuously develop exposed photographic films, and the like.

With reference to Fig. 2 it will be understood that suitable means, not illustrated, may be provided for transferring the prints from fixer bath 80 to rinse station M.

What is claimed is:

1. A device of the class described for developing exposed photographic prints, said device comprising an open topped receptacle, a perforated conveyor for moving said prints individually in a flatwise manner face up, above said receptacle, and applicator means for spraying a developer solution onto the upper face of said prints and the perforated conveyor supporting the prints, said conveyor in the area beneath the spray applicator having its perforations unrestrictedly open to afford immediate drainage of the solution through the conveyor where the solution strikes the conveyor, the length of conveyor travel exceeding the area covered by said spray means whereby the prints will be exposed to the action of

the developer solution for a limited length of time less than the total time required for complete development of the prints, and then be exposed to the atmosphere with the conveyor and the prints thoroughly drained of developer solution, until the development action is complete, and means for recirculating the drained developer solution from the receptacle to the spraying means.

2. In a device for treating exposed individual photographic prints having sensitized front surfaces and non-sensitized rear surfaces, the combination of bath means including a traveling endless conveyor belt having through drainage perforations, for advancing a series of prints with their sensitized surfaces exposed upwardly, while the rear surfaces thereof rest flatwise in such full contact upon the conveyor belt as to protect said rear surfaces from substantial exposure to liquid sprayed downwardly toward the belt and onto the sensitized surfaces of the prints, the perforations of the belt being unrestrictedly open, and so spaced and numbered as to be disposed beneath and about each print, with a sufficient number of perforations remaining exposed for immediately draining the sprayed liquid from the belt and precluding floatation of the prints, and an overhead applicator for spraying treating liquid downwardly onto the belt in the area of the unrestrictedly open perforations thereof, in such quantity as would float the prints in the absence of the immediate drainage aforesaid.

3. In a device for treating exposed individual photographic prints having sensitized front surfaces and non-sensitized rear surfaces, the combination of bath means including a single thickness endless conveyor belt means having through drainage perforations, for advancing a series of prints with their sensitized surfaces exposed upwardly, while the rear surfaces thereof rest flatwise in such full contact upon the conveyor belt as to protect said rear surfaces from substantial exposure to liquid sprayed downwardly toward the belt and onto the sensitized surfaces of the prints, the perforations of the belt being unrestrictedly open, and so spaced and numbered as to be disposed beneath and about each print, with a sufficient number of perforations remaining exposed for immediately draining the sprayed liquid from the belt and precluding floatation of the prints, and means for spraying treating liquid as stated, in such quantity as would float the prints in the absence of the perforations aforesaid, said conveyor belt means and spraying means being arranged in multiples, with successive conveyor belt means aligned to pass the individual prints from one of said belt means to the next, sensitized surfaces uppermost, and rinsing means for the prints comprising an overhead water spray, and a series of driven endless belts having upper reaches traveling in a common direction, and in stepped spaced relationship one to another with the reaches of successive rinse belts each underlying the reach of a preceding rinse belt, whereby any print in leaving one rinse belt is uninfluenced by a succeeding rinse belt, and therefore tends to follow said one rinse belt toward its lower reach, thereby exposing the trailing edge of such print to the overhead water spray to initiate dislodging the print and depositing it upon the underlying portion of the next succeeding rinse belt in an overturned condition.

4. In a device for treating exposed individual photographic prints having front and rear faces, 75

the combination which comprises means for advancing the individual prints in flatwise condition and in succession, a liquid spraying device to rinse the prints, and a series of driven endless belts having upper reaches traveling in a common direction, said reaches being in stepped spaced relationship to one another, with the reaches of successive belts each underlying the reach of a preceding belt, whereby any print in leaving one belt is uninfluenced by a succeeding rinse belt, and therefore tends to follow said one belt toward its lower reach, thereby exposing the trailing edge of such print to the liquid discharged from the overhead spraying device to initiate dislodgment of the print and deposit thereof in an overturned condition upon the underlying portion of the next succeeding belt.

5. Automatic equipment for processing individual exposed photographic prints, comprising in combination an aligned succession of separate developing, rinsing, and fixing means, including belt conveyors arranged to advance individual prints substantially continuously with their image-carrying faces exposed, means for spraying developing, rinsing, and fixing liquids onto said print faces as the prints are advanced by the succession of conveyor belts in the order stated, and print washing means arranged to receive the prints from the conveyor of the fixing means, including a succession of moving conveyor belt reaches traveling in a common direction, said reaches having curved end portions overlying one another in spaced relationship and to which the wet prints adhere while following the curved end portions, thereby reversing the prints at the end of each of said conveyor reaches, and sprays of washing fluid so directed at the prints as they follow said curved end portions of the conveyor reaches, as to dislodge the prints therefrom and effect deposit thereof onto the next succeeding conveyor reach in an overturned condition.

6. In a device for treating exposed individual photographic prints having sensitized front surfaces and non-sensitized backs, the combination of bath means including an overhead treating fluid applicator, and a perforated traveling belt beneath the applicator arranged for advancing a series of prints past the applicator with their sensitized surfaces exposed upwardly, while the backs thereof cover some only of the perforations and rest flatwise in contact with the belt, the perforations of the belt not covered by the prints being unrestrictedly open beneath the applicator, to afford immediate drainage of treating fluid where the fluid strikes the belt and the prints superposed thereon.

7. In a device for treating exposed individual photographic prints having sensitized front surfaces and non-sensitized backs, the combination of bath means including an overhead treating fluid applicator, and a perforated traveling belt beneath the applicator arranged for advancing a series of prints past the applicator with their sensitized surfaces exposed upwardly, while the backs thereof rest flatwise in contact with the belt to protect the backs of the prints from substantial exposure to treating fluid from the applicator, the perforations not covered by the prints being unrestrictedly open beneath the applicator to afford immediate drainage of treating fluid where it strikes the belt and the prints superposed thereon, said perforations being so spaced and numbered as to be disposed beneath and about the prints with a sufficient number of

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perforations openly exposed in the region of application of the treating fluid, to freely drain the fluid and prevent flotation of the prints.

8. In a device for treating exposed individual photographic prints having sensitized front surfaces and non-sensitized backs, the combination of bath means including an overhead treating fluid applicator, and a perforated traveling belt beneath the applicator arranged for advancing a series of prints past the applicator with their sensitized surfaces exposed upwardly, while the backs thereof rest flatwise in contact with the

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belt to protect the backs of the prints from substantial exposure to treating fluid from the applicator, the perforations not covered by the prints being unrestrictedly open beneath the applicator to afford immediate drainage of treating fluid where it strikes the belt and the prints superposed thereon, the travel of the belt being extended sufficiently beyond the area of treating fluid application to complete the exposure of the prints in the presence of atmospheric air freely accessible thereto.

ALVIN L. MAYER.